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ON NOCTURNAL ANIMALS.*

BY JAMES MURIE, M.D., LL.D., F.L.S.

A CONSIDERATION of all that is known respecting the habits and manifold peculiarities of those animals whose active phases of life come under the denomination "nocturnal" is manifestly impracticable within the limits of the present paper. A selection of instances in point, therefore, is unavoidable. In this case preference is given to the Vertebrata, inasmuch as many are familiar objects in our public gardens and travelling menageries.

Scarcely one of the subkingdoms and classes of animals can be named but has a subordinate group, or more often a limited section, or species of a group, which, in contradistinction to its fellows, exhibits abnormal habits and manifests a preference for darkness over daylight. Very frequently there is associated with this exceptional habit some diversity in organs and subsidiary structures adapted to the creature's particular mode of life. Still occasionally where no pronounced structural differences are observable one is at a loss to account for singularity of habit. Something, therefore, which is not always apparent may underlie this tendency to variation.

Can it be that one or more dominant though hidden forces are at work that at least would partially explain the enigma? Or

* This article is based upon a lecture delivered by the writer during the present summer, in the course of "Davis Lectures" at the Zoological Society's Gardens. It has been modified, however, in some respects, and especially in the elimination of much that was stated with regard to the lower forms of life.

are animals actuated by the varied motives which influence reasoning mankind, subdued and modified, as a matter of necessity, from imperfection in their structural detail?

Carlyle has quaintly said that "the two great moving powers of society are hunger and the policeman." Sternly inexorable is the former, a humiliating necessity the latter. Now as animals must eat to live, it is not unnatural that they should be found abroad at such times as their prey is most easily procurable. Moreover, they have cautiously to avoid their own enemies, and thus find safety in feeding under cover of darkness. But besides the craving for food there seems another influence which, though at first less recognizable, is possibly much stronger in its potency—namely, an inclination to seek shade. Throughout the animal kingdom generally, but more especially among the lower forms, examples of this are numerous. Coincident with an uncomfortable feeling, howsoever produced, is retirement to shade. In short, light acts as a stimulus, not equally shared by all creatures. Its influence on protoplasmic matter is evident, and is of continual occurrence even among animals of most imperfect organization. Traced upwards from these, the reception of sensory stimuli presents us with superadded or adaptive structural modifications often rendered acute to a degree.

How gradual development from simple to more differentiated conditions has been brought about in the march of time, and what may be the relation of transmission of qualities from parent to offspring I leave unanswered as involving discussion apart from the immediate purport of this article.

Premising that nocturnal activity is the sequence of an endeavour to shun light, as annoying or detrimental to the organism, and that in certain cases search for food or other functional impulse necessitates nocturnal habits, I shall confine my remarks accordingly.

In using the term "nocturnal," I would wish it to be understood in its widest sense. Thus the great mass of animals are abroad, feed, and otherwise are actively employed, so to say, *in their business of life*, during daylight and sunshine, that is, from morn till eve. Not a few, however, from preference or necessity, are then in retirement, from which they only emerge between nightfall and sunrise. Others choose twilight or the "gloaming"—that hazy obscurity which precedes the setting in

of night; while others, again, roam at early dawn, when stillness and imperfect light prevail. The term "diurnal," in strictness, is applicable to the first mentioned; the three others may therefore be classed under the head "nocturnal," although the term "crepuscular" is not unfrequently employed to designate those animals whose habit it is to issue forth in the glimmering betwixt light and darkness.

But the limits of separation are not easily defined, notwithstanding breadth employed. Take mankind collectively, and without hesitation they would be classed as diurnal creatures; yet a moment's reflection will show that, either from choice or necessity, many individuals lead a truly nocturnal life. Nor can it be said the crepuscular element is here wanting, albeit the use of artificial light. Again, Herbivores, the Deer tribe particularly, are diurnal, yet under certain conditions—*i. e.*, during the breeding season—they temporarily become night-roamers. Other somewhat corresponding instances of change from ordinary habit may more fitly be referred to in the sequel.

An explanation of some of the peculiar phenomena observable among Nocturnal Birds and Mammalia (Bats to wit) would be incomplete without a due consideration of the senses and sensory organs of a few of the inferior orders of the Invertebrata, as elucidating fundamental principles.

Quite at the bottom of the scale which zoologists have to deal with are the group of Protozoa,—creatures all more or less of the simplest construction, and for the most part microscopic in size. Little indeed is there to be shown in the organization of such a form as *Protamœba primitiva*, Haeck, where alone a faint greyish coloured and translucent, granular, gelatinous substance is recognizable. This jelly-like material, notwithstanding, possesses all the essentials of animals far higher in the scale, inasmuch as, without any organs whatsoever, the necessary functions of organic life and reproduction are performed. Its sarcode is sensitive to impressions—*viz.* subject to irritability; hence contraction and expansion—*i. e.*, movement. It suffers waste of tissue, hunger follows, and supply means assimilation of nutrient at any point, and simple division means reproduction. But as bearing on our question at issue, of greater signification is the remarkable property of this jelly's having a diffused sense, equivalent to touch. Thus this so-called sixth sense of some

writers, modified in a variety of ways, becomes an important factor in all that relates to adaptation to "nocturnism," if such an expression is admissible.

Possibly the above and others of the Protozoa are not strictly nocturnal, though some shun direct sunlight. But whether heat-rays may have a determining influence is an open question.

Among the Medusæ, or Jelly-fish (*Cælenterata*), which, though met with during the day-time, abound most frequently, in calm, clear weather, at the surface towards nightfall, or when complete darkness has set in, sensory organs of a most rudimentary kind are developed. Nerveless, as ordinarily understood, yet, according to the recent researches of Romanes, Eimer and others, defined lines of sensory impressions exist in the sarcodous jelly of their umbrella. In fact, reflex action is apparent, minus true nerves. A few minute calcareous particles aggregated together or within a sac scattered towards the periphery of the umbrella, acoustic vesicles, are forerunners of organs of hearing; and for eyes there are pigment spots at the base of the tentacles, the latter themselves being feelers.

Thus the Sea-blubbers are instructive as evincing diffused sensation along with localized spots wherein this touch becomes, by slight differentiation of tissue, instrumental in the production of hearing and sight, of course in an inferior degree. Although absolute proof is wanting, it is quite within the range of probability that their stomachal cavity appreciates in a faint degree approaches to a low kind of taste and even smell. In some genera more diurnal in habit, their extreme sensitiveness to light is manifest by their immediately closing and descending when heavy clouds dim the atmosphere.

The foregoing well illustrates Mr. Herbert Spencer's views ('Principles of Psychology'), *viz.* :— "For every higher phase shows itself as an ability to recognise smaller and smaller differences, either of kind or degree, in attributes of surrounding bodies; and so render it possible still further to specialize the adjustment of inner to outer relations."

In nocturnal animals this principle is carried to its fullest extent, all adaptations to habit being connected with endowment of extra sensitiveness specialized.

The Annelids, however, afford plentiful examples of preference for darkness; and the common earthworm is both easily observed

and procurable for examination. Except in damp weather and dull days, they are shy and not much given to be abroad; but in the evenings, all through the night and early morn, especially during moist weather, they crawl hither and thither with unrestrained freedom. Keen fishermen know when best to seek their bait, and the proverb of the "early bird finding the worm" points to grey dawn. Here then we see that the nocturnal habit of the one creature superinduces the necessity of similar habit in the other. The bird's own enemy, again,—it may be reptile or mammal,—must stir betimes; and thus, from class to class, the nocturnal and crepuscular habit is transmitted. Once acquired and perpetuated, modification of organs adapted to the altered circumstances ensues. Tactile sensation among groups of the Vermes is through minute skin modification, papillæ, bristles, or cup-shaped bodies, all in connection with the nervous system. Though the earthworm itself is blind, it is not so with others, where evolution of visual organs from indifferent condition to complex lens, crystalline rods, cones, &c., is well marked. Auditory organs are also present in some.

With regard to the Mollusca, and with them we may associate the Crustacea, some doubtless are nocturnal; others live at depths where only a modicum of light is admissible. Not a few retreat to darkness under cover of rocks, stones and sea-weed. But slugs and snails are active after sundown, and all night long commit their ravages, while their reptilian and avine pursuers have to follow suit.

Of Arachnida, Myriapods, and quite a host of the division of Insecta, one is at a loss by the *embarras de riches* of those that carry on their life occupations under cover of darkness. Suffice to recall some of the Trap-door Spiders and their ingenious devices so graphically pourtrayed by Mr. Moggridge; while to those who have felt the effects of the nocturnal attack of the venomous Scorpion, the name is sufficient. Deeply interesting is Mr. Moseley's researches on the caterpillar-looking nocturnal Myriapod of the Cape of Good Hope (*Peripatus capensis*). It is there quite local in habitat, and is found under dead wood, wherefrom it creeps out at dusk. A pair of horn-like antennæ project from its head, and it crawls by the aid of seventeen pairs of hooked, conical feet. It breathes air by trachea and stigmata. Cutaneous glands secrete a viscid fluid, which, Capt. Hutton

asserts, is thrown out, as if by magic, in fine thread-like jets, and by this viscous web insects are caught and afterwards devoured. Mr. Moseley believes this creature is of great antiquity, and the ancestor of spiders, Myriapods, and insects. If so, then nocturnal habits are not of recent introduction. The variety and modifications of apparatus manifest among nocturnal insects, and as adaptive to that habit, almost forbid attempt at selection of instances.

The Vertebrata have their full share of night-hunters, and equally can Fish, Amphibia, and Reptiles be cited.

When we come to Birds (Aves), we find that although the majority are diurnal, yet many are habitually crepuscular—either found on the wing as the sun goes down, or abroad for their living early in the grey dawn. These very often pass the day-time tranquilly or dozing under shade, and stir about between lights, though roosting at night. Birds with young are urged by the maternal instinct, and will then keep late and early hours, quite out of their usual way.

But in generalizing on nocturnal habit, it should not be forgotten that what applies to the northern regions does not always hold good of the tropics. As we near the equator, sundown all the year round means quick and often intense darkness, to be continued till sunrise, and consequently there is a certain seasonal uniformity in animal habit. In higher latitudes summer twilight stretches further on, and the first blush of the morning quickly succeeds. It follows that diurnal groups of birds and mammals of the tropics acquire more crepuscular habits the further north they go, particularly in the summer season; and winter weather correspondingly brings change of hours.

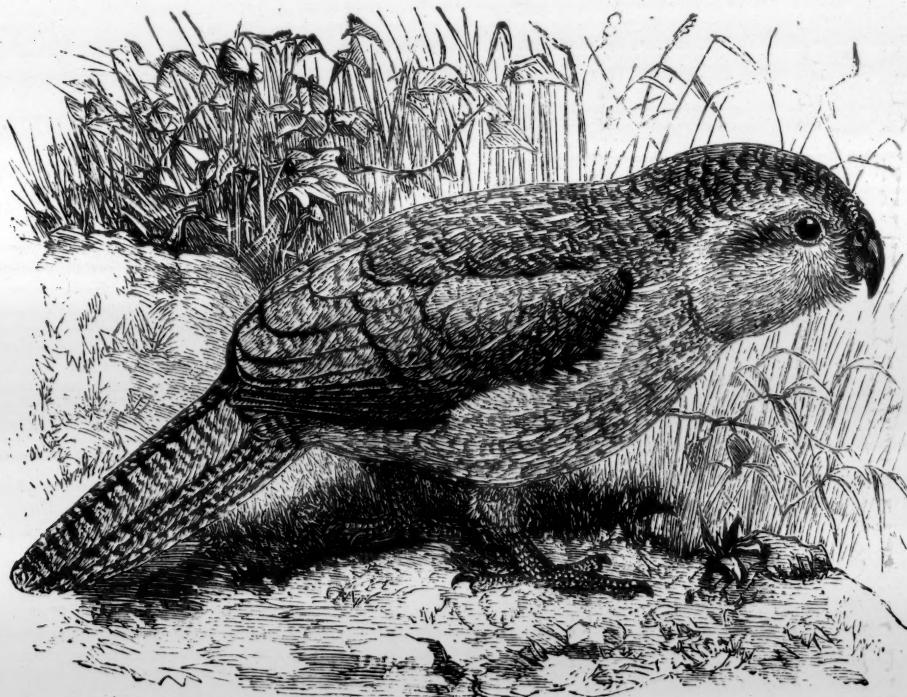
The Struthionidæ (Ostrich group) attract attention in having one New Zealand genus, the diminutive *Apteryx*, which is a night-hunter. It might be interesting to know if its island congeners, the great extinct species of *Dinornis*, were also nocturnal—a question easier asked than likely to be satisfactorily answered, though I should say they probably were. The night habits of the *Apteryx* are well attested, those confined in this country being as shy of daylight as their wild brethren in New Zealand. Selecting a dry hole in sand, tree, or log as their usual abode, or artfully concealing themselves among the dense beds of fern, the Kiwis lie, generally in pairs, torpid and drowsy while day lasts. The approach of night sees them awake and hunting

hither and thither for their food. This is not of a vegetable nature, but consists of worms, snails, lepidopterous larvæ, and such insects as they come across. At such times the very marked peculiarities of the long, narrow, terminally knobbed beak, the loose, freely movable brush of tactile rictal vibrissæ, the hair-like feathers set all over the body and short stout legs, are plainly adaptations fitted to its nocturnal search for food. As regards the eye, this has an absence of pecten or marsupium compatible with night habit, and it is relatively smaller than in the other Struthionidæ. This is amply compensated for by feathering, and especially the extremely sensitive vibrissæ. These at every motion of the bird inwardly convey impressions of touch, and guide it among the dense grass and vegetation where sight might be less available. It is said to make a sniffing noise when searching for food, possibly produced by the imperfect closure of nostrils placed, most unusually, at the bulbous extremity of the beak, as this latter is inserted among the loose soil and herbage. But at all events the careful dissections of Professor Owen show that the organs of smell and taste, as well as hearing, are unusually well-developed. In this case the point of the bill, with its nerve-endings, has a sense of most delicate touch over and above olfactory power. Without going into other detail of structural differences between the *Apteryx* and others of its order, enough has been said to show that functionally the former is modified to adapt it to nocturnal habits.

Amongst the noisy diurnal group of Parrots (*Psittaci*) are two night-roamers. One of these is a New Zealand form, and the other a native of Australia.

Of the singular New Zealand Night Parrot, or Kakapo, as the natives name it (*Stringops habroptilus*), Dr. Günther informs me that it is reported as a perfect nuisance to the shepherds. In the dark it steals among the sheep, and, mounting their backs, vigourously searches for all the ticks and vermin it can find, but in the search it not unfrequently tears the skin and flesh as well as the wool. In this respect it is a bad imitator of the African Oxpeckers, *Buphaga*. The *Stringops* is a larger bird than *Geopsittacus*, presently to be mentioned, though intensely like it in its sap-green colour, markings, and outward aspect generally. It has a dazed eye during the day, indicative of moderate light being most suitable for perfect vision. The

wings are relatively short and rounded, and although it has parrot-like feet, yet these are adapted more for ground-running than grasping. It has a somewhat strigine face, the radiating feathers around the eyes simulating the facial disk of the Owl's, while numerous tactile hairy feathers prominently occupy the root of the beak. Dr. Günther's statement, as above, denotes an insectivorous bird, or one that would not despise worms or other vermin, but other information on its habits leads to the supposition of a preference for vegetable food. Dr. Sclater remarks of that living in the Gardens in 1875:—"The *Stringops* is most strictly nocturnal in its habits, and never emerges from the box in which it is kept, voluntarily, during daylight. Our specimen has no power of flight, but uses its wings to aid it in running. It feeds upon oats, apples, lettuce, carrots, and other vegetables, and appears to thrive well upon this diet."



NEW ZEALAND NIGHT PARROT.

Stringops habroptilus, Gray.

Sir George Grey records of the Kakapo that during the day it remains hid in holes under the roots of trees or rocks, rarely perching. Sleepy and stupid as it hides among the grass during the day, at sunset it becomes lively, animated, and playful, then

feeds, with a grunting noise of satisfaction, on grass, weeds, fruit, seeds, and roots. It grazes or nibbles the grass in the manner of a Rabbit or Wombat.

In Mr. D. Lyall's account of the wild bird, in his communication to the Zoological Society, he mentions that at the south-west of the middle island of New Zealand he found them living in communities on flats at the river's mouth near the sea, and more hillwards; tracks a foot wide abound where they run about. As many of the roots of trees are above ground the Kakapo burrows among them. Flight was rarely seen, and then for very short distances, the wings scarcely moving, and the bird, alighting on a lower level, only gained height among the hollow trees by climbing, the tail assisting. It is seldom or ever seen during the day, and dogs are used to hunt it. Indeed, the dogs which have run wild, with the cats, besides man, are rapidly exterminating this strange Parrot. There can be little doubt, he says, that their food consists partly of roots (their beaks are usually more or less covered with indurated mud), and partly of the leaves and tender shoots of various plants.

Another writer, Mr. G. S. Sale, who kept one alive in this country some time, says its playfulness is remarkable; it will run from a corner of the room, seize the hand with claws and beak, and tumble over and over with it exactly like a kitten, and then rush back to be invited to a fresh attack. It is also humourous, dancing with outstretched wings, evidently shamming anger. It is generally lively enough during the day, but not so noisy as at night.

The Western Ground Parakeet (*Geopsittacus occidentalis*, Gould) has considerable resemblance to *Stringops* and to *Pezoporos*, another ground-loving Australian Parakeet. *Geopsittacus*, however, lives in rocky caves and comes out at night to feed, as Mr. Ryan, of the Gawler Ranges, Spencer Gulf, assured Dr. Müller, and this is corroborated by Mr. A. D. Bartlett's observations on a bird in the Zoological Gardens. As might be expected from its habits, the wings are like those of many night-flying birds; the eyes, of moderate size, in daylight have a strange hazy expression, not easily described, but quite characteristic of nocturnal animals. The cere is unusually full and fleshy, with wide nostrils, and a pencil of elongated hair-

bristles below. The bird appears to be a vegetable-feeder, and is almost noiseless, uttering very rarely a harsh double note.

The Owls (*Strigidæ*) present some strange modifications, and prominently display the fact that organs, by almost insensible gradation of structural change, are equally adapted for use by daylight, semi-darkness, and night. Only intensity of sensory power is secured where absence of light is essential to their well-being. What more applicable to noiseless flight than their fluffy feathers, whose lightness is strengthened by additional serrated delicate barbules interlocking and giving the gossamer framework efficacy for nocturnal purposes? Their great curiously-set eyes, with enormously broad iris and other anatomical attributes, so dazed in the sun's glare, light up and receive every faint ray of night reflection; their auditory apparatus, with great open tympanum, downy plumage, and circlet of feathers, in substitution for an auricle, guiding and concentrating sound, however faint, to the recesses of an ear specially constructed as a receptacle for appreciation of vibratory movement. The facial disc, the peculiarities of cere and nostrils, the beak and talons, all betoken adaptive power as aerial night-hunters.

The Nightjars (*Caprimulgidæ*) are equally creatures of night; but, unlike the Owls, their enormous gaping mouth, defended by stiff bristles, is an adaptation implying hunting and securing prey on the wing. Swallows of the night, the Goatsuckers possess a plumage vieing with the Owls in soft delicacy and lightness. The eye equally and specially conforms to the principles necessitating vision in the uncertain haze of twilight and night. The diminutive weak legs present no characters of a percher, and the bark-like plumage of the bird, when resting and cowering on boughs, protects it from its diurnal enemies. It has a peculiar pectinated claw on the middle toe, which may either facilitate its balance on a bough or be used as a cleansing tool when broken moths'-wings stick around the gape. No nocturnal beetle or sphinx moth, however powerful on the wing, is safe from the noiseless circling sweep or rapid dash of "the awaken'd Churn-owl."

Many other birds besides the foregoing are nocturnal; but these illustrate sufficiently how sensory organs are correlated with crepuscular habit.

In passing to Mammals, numerous groups are found with decided night tastes. Monotremes, Marsupials, Edentates, Rodents, Carnivora, Insectivora, &c., all furnish marked examples. Some are burrowers, others partially aquatic, others again arboreal, no animal profession being unrepresented.

The Cat tribe is familiar. Their cushioned feet give softness of tread; their hearing is exceedingly good, though their outer ears may be small. Long bristly whiskers stand out, and as tactile organs quickly convey impressions of surrounding objects. Smell, too, is acute, though not used equally by all to obtain prey. Sight, however, is most relied on. The greenish or sometimes reddish glare of the feline eye is familiar, as well as that of other nocturnal mammals. This is produced from the *tapetum*, a brilliant iridescent membrane immediately beneath the retina, whose finely ribbed surface produces the coloration as an interference phenomenon.* The ensheathed sharp claws and cat-like and muscular development of the body complete organisms all highly adapted for the capture by night of often powerful prey.

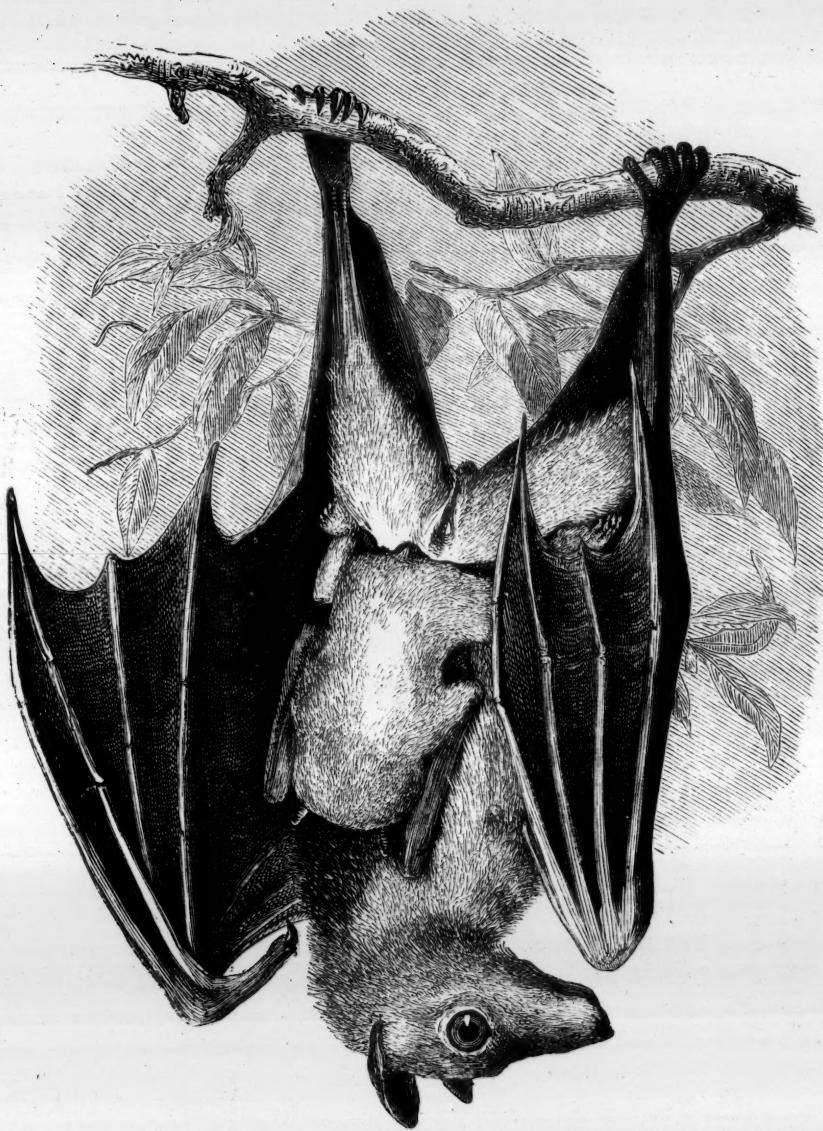
But even in the case of Ruminants which, as a rule, are diurnal, night excursions among the vast African herds occasionally happen. The Grysbok during the day lies hid in reed-beds, and regularly feeds at night.

The Elephant and the Tapir are often night-roamers, want of water being a chief incentive with the former; its great ears as tactile organs are then useful in treading in the gloom of the forest.

The Star-nosed Mole (*Condylura*) and the *Urotrichus* may be cited as instances where the lengthened nose, having fringed processes of a tactile kind, supplies this deficiency of sight.

Among the entire range of nocturnal animals none exhibit so strikingly, or in so high a degree, the diffused sense of touch (referred to when speaking of the very lowest animal forms) as the Bats (*Chiroptera*). So accustomed are we to associate them with the dusk that when the writer once saw, in Central Africa during the middle of the day, a flight of literally myriads of great Fruit Bats, he was as much astonished at the diurnal spectacle as

* There are two forms of *tapetum*—1st, cellular, as found in fishes and carnivora, whose cells contain lime-crystals in the former, seldom in the latter; 2nd, fibrous, as found in many other mammals.



THE COLLARED FRUIT BAT.

Cynonycteris collaris, female, showing mode of carrying young.

at the numbers. They covered the sky like a cloud, and kept steadily passing over for many minutes. Though keen-sighted, Bats generally have rather a sharp rat-like eye than an ocular apparatus indicating a large field of vision. The dark colour of the eyeball, as a rule, prevents the contraction (often to a pin's point) and expansion of the iris and pupil being readily noticeable; though there is considerable power in this respect. But if the eye of a large Bat—such as that depicted in the

woodcut—be attentively observed when exposed to the strong glare of sunlight, that hazy, lustreless expression so indicative of night habit is readily appreciated.

Hearing in these animals is a well-developed sense. Not only is the internal ear a highly efficient organ, but, as is well known in several of the Bat families, the enormous size of the thin membranous conch is out of all proportion to the dimensions of the animals themselves. Moreover, the tragus, especially in the *Nycteridæ* and *Vespertilionidæ*, is extraordinarily exaggerated. The external nasal apparatus, even in our English Horse-shoe Bat (*Rhinolophus*), is an extremely absurd-looking nose-leaf; but in the Vampires (*Phyllostomidae*) and Megaderms the same part, in size, complexity, and ugliness, almost exceeds the ridiculous. Smell, in fact, like hearing, has a superadded intensity, through the exterior apparatus and its wonderful tactile power. Taste, in the Fruit Bats, at least, is in no way deficient, though probably little influencing nocturnal peculiarities. Concerning touch, it is the strangest physiological problem in the whole history of their economy. The wing membrane of a Bat, most persons are aware, is a thin tegumentary extension stretched between the enormously lengthened but attenuated bones of the hand (see figure)—that is, both palm and fingers. At one bend, that which represents the wrist-joint, is a short-clawed grappling-hook, the thumb. The lower and upper arm bones are each greatly elongated, especially the former. This long-levered arm, which otherwise would be weak and futilely beat the air when outspread, is further strengthened and improved as an organ of flight by a delicate though tough web running out like a guy-rope in front. Furthermore, a continuation of broad web reaches from the inner finger and arm to the body, and onwards to the heel. The form of the tail varies in different genera, and is capable of being extended according to the length of the membrane by which it is attached to the sides of the leg. Throughout all this extent of membrane highly elastic tissue and minute muscular fibres are so distributed that the web can be partially or wholly furled as circumstances require.

The young cling to the mother by clutching her most tenaciously, and she flies about or roosts head downwards, enveloping her offspring with the wing-membranes. But the wing- and leg-webs, the great membranous ears, and, indeed,

all the sinuosities of facial and nasal flaps, &c., subserve a sensory purpose necessary to the well-being of these nocturnal creatures *par excellence*. Though often transparent, flesh-like, and seemingly bare, yet everywhere, and scattered on both sides, are extremely slender, delicate hairs, the bulbs of which widen out and enclose minute tactile organs (*Tastkorperchen* of Dr. Schöbl). Added to these, fine nerve-threads are freely distributed; and, as if further to enhance the extreme sensibility of the part, a perfect network of contractile capillary blood-vessels.

Hence, as in the Amœba and Jelly-fish, every particle of the surface is a tactile apparatus with a sensitiveness possibly unrivalled in the animal kingdom.

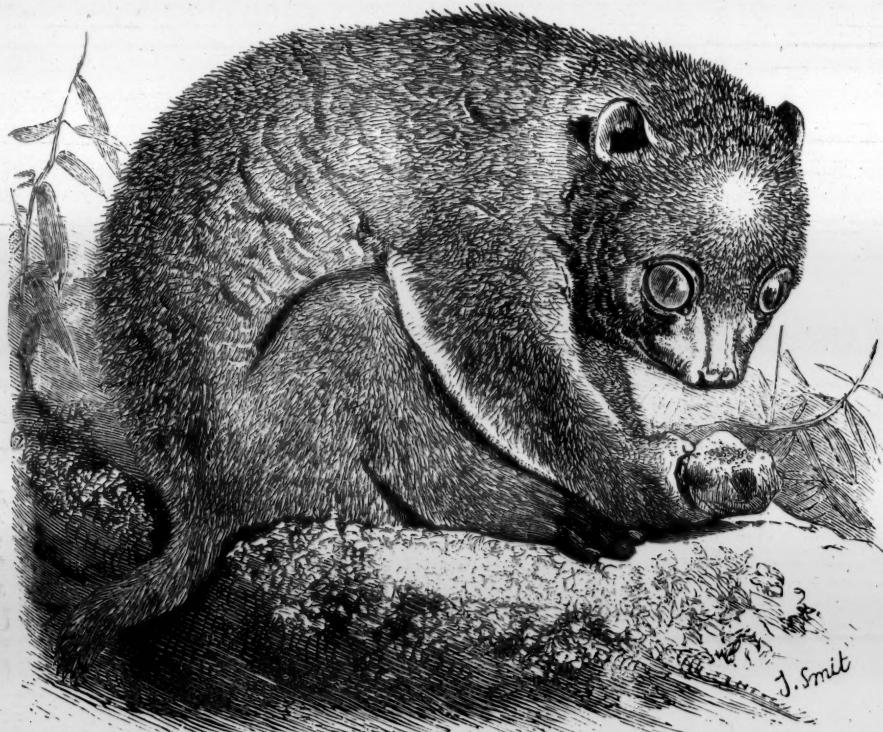
For a long time it was inexplicable how Bats flew in the dark with unerring certainty. The remarkable experiments of the earnest and shrewd Abbé Spallanzani showed that, after eyes, ears, and nose were destroyed or obliterated, so far as sensation or use was concerned, the mutilated creatures avoided every minute obstacle placed in the way; they even threaded dark caverns, and found out nooks and crevices in a most extraordinary manner. That the result of these experiments was not mere accident or good luck on the part of the Bats has been shown by Jurine and Schöbl, who repeated them. Moreover, the careful microscopic researches of the latter have revealed, as above stated, structural conditions not previously suspected.

One can no longer wonder, then, how important and efficacious to crepuscular and night-roaming animals are long vibrissæ, erectile spines, filaments, and such-like organs, as well as the tactile delicacy of palm, pads, &c.; in fact, impressions are by these means conveyed, which to diurnal animals are unknown and unrequired.

Though not absolutely rivalling the Bats in constancy of nocturnal habit, or endowed with the sense of touch in its broadest aspect, still the *Lemuroidea*, or Half-Apes, as some naturalists designate them, are marvellously interesting, from their adaptive structure to nocturnal habit. Some are cat- or fox-like in build or expression, others puggish; all are quadrumanous, with big opposable thumbs and great toes; a few possess abnormally developed fingers; none are so intelligent and mischievous as

monkeys. Those of the genus *Lemur* are much more diurnal in habit than their congeners, or rather, they are out morn and eve, and often sleep of a night. But the majority of Lemuroids are, truly speaking, nocturnal animals.

The "night-eye" is dominant, with its vertical and changeable pupil, passing from faint streak to wide circle. Most of the species have thick tactile whiskers. The abnormal bulbous tips of the toes are quite peculiar looking, but their utility is explained by the fact that each pad is an exquisitely sensitive apparatus, possessed of a marvellous power of touch. These creatures see, as it were, through their fingers, like the blind man. There is much difference with regard to ears; in the Loris group they are of moderate size; the *Tarsius*, the *Aye-Aye* and *Galagos*, on the contrary, have great bat-like ears, the latter singularly movable. All are most sensitive to changes in temperature, and soft furry coats are noiseless protectives in their night rambles.



VAN BOSMAN'S POTTO.

Perodicticus potto, Gmelin.

As each group of the Lemuroids is constructed, *sui generis*,—for night exploration, a brief glance at one or two of the most

singular is all that can here be taken. The Potto or Bush-dog (*Perodicticus*) is one of the stumpy West African slow-moving species. A short tail and well-nigh obsolete fore finger are its chief exterior characteristics. Its habits are so similar to the better known Asiatic Slow Loris (*Nycticebus*) that reference to the latter will serve both. Seen in the daytime, or made to walk on a flat surface, from its weird-looking eyes, sack-like body, long limbs, and slow straggling gait, one would predicate it the worst of night-hunters; but give it a grasping surface and place a beetle before it at night, and the eye lights up like a globe of fire: the quiet demeanour and sudden rush on the prey is astonishing. The perfect silence in movement, tenacity of grasp in climbing, tactile appreciation and dilatable eye, all enable the creature stealthily to approach birds, insects, and creeping things, and to snatch at and secure them in a twinkling. The great-eared Javan Tarsius and the African Galagos, on the other hand, are perfect imps of nimbleness. Their furling ear-conch catches every sound, their sensitive palms and facial vibrissæ warn them of every obstacle in their path, and the unusually lengthened heel-bones, like frogs, enable them to spring astonishing distances, so that they are on their prey like lightning.

The great-eared Aye-Aye of Madagascar, so lucidly described by Professor Owen, is even more curiously adapted for its peculiar nocturnal rambles. It seems almost blinded by daylight, but brilliantly orb'd in darkness. The two middle fore-fingers are bat-like in tenuity and length, and probe nook, crevice and corner with super-sensitive tact and skill. Its whiskers and skin warn by delicacy of touch, and its strange rodent-like teeth serve as effective chisels in night hunts for creatures, the presence of which ear and finger alone indicate.

The Lemuroids, as a whole, then, embody perfection in varied apparatus useful nocturnally. As with the Bats, Mr. Herbert Spencer's principle is highly applicable, *viz.*, "There can be no doubt that the sensation of touch and pressure are consequent on accelerated changes of matter produced by mechanical disturbance of the mingled fluids and solids composing the part affected."

The Douroucouli (*Nyctipithecus*), a small animal allied to the Capuchin and Squirrel Monkeys of South America, decidedly leads a nocturnal life. Several species have from time to time

been kept at the Regent's Park Gardens. Visitors seldom see a specimen; for, like the Slow Loris (*Nycticebus*), it cuddles up during the day time and seeks shelter in its box. When poked it seems bewildered by the light, and the eyes present the dazed appearance common to the Nocturnal Lemuroids. Like the latter day-sleepers, it brisks up at sunset, and then is active, when all other of the monkey tribe slumber. In general anatomical structure it resembles the *Cebidæ*; but the molar teeth are tuberculate; the iris has great power of expansion and contraction, the great round pupil at night giving quite a different expression to its contracted diurnal aspect; and lastly, the palms of the fore feet exhibit more tactile properties than is common to the generality of the monkeys. Functionally, therefore, eye and finger-tips, or sight and touch, have become extremely sensitive to impressions, by a change in the minute tissues of a very limited kind; but they are just sufficient, along with the slight dental cusps, to effect a radical change adapted to night habit and insectivorous food. In the dark virgin forests, the Doroucoulis after nightfall nimbly lay hold of small birds and chase the spiders, beetles, cockroaches, and other nocturnal insects—even bats they are said to devour—though they by no means despise sugar-cane, fruit, and nuts. In the Zoological Gardens it is difficult to rouse the creature during the day; but Mr. Bates says that in the Amazons they are aroused by the least noise, so that when a person passes by a tree on which a number of them are concealed he is startled by the sudden apparition of a group of little striped faces crowding a hole in the trunk.

Thus true Apes and Monkeys (*Quadrumana*), with the single exception of the South American genus above mentioned, are in the full swing of their ceaseless activities and eccentric pranks in broad daylight. Just before sunset, when in the forest, one occasionally hears a chattering noisy lot either settling friendly differences or having a final "scrimmage" ere repose, but no sooner has gloom spread than all is hushed. Even in our Zoological Gardens, where the creatures feel secure from night attack, their silence then is in marked contrast to their companions, the Lemurs. Some monkeys when in their native haunt are astir at grey dawn, and in bands make for the nearest plantations, commit ravages, and scamper off before the sun has got well up in the horizon. Man has then his part to play; and

so by interdependence of habit, from lowest to highest of the animal kingdom, the round of night labours and watchfulness goes on.

In a mere sketch like the present, the subject obviously receives but scant justice; for many interesting nocturnal animals, peculiar habits, and curious structural conditions suggest themselves, of which no mention has been made. Nevertheless one may be justified in a retrospective summary of the points influencing, doubtless to some extent, nocturnal habits.

All animals suffer waste, and necessarily require food and drink to repair waste of tissue. To supply these they must needs obtain them at such times and places as they are procurable.

Animals, moreover, are influenced by the surrounding medium and environment generally, and light especially, as well as temperature, often cause uncomfortable sensations.

Many hence endeavour to shun excess of light, and, in so doing, seek night or cool twilight to perform their active functions.

By dependence upon one another for sustenance, by precautions of safety against enemies, and occasionally by seasonal occurrence of procreative faculties, or the rearing of offspring, and by other economic reasons, nocturnal habit may be acquired, retained, and ultimately transmitted.

The organs of sense, more particularly touch, hearing, and sight, usually become highly irritable, and, from lowest to highest animal forms, sensory apparatus gets specialized. By slight alteration in textural qualities functional intensity is superinduced, and touch almost amounts to a sixth sense.

In a number of cases the same group has diurnal and nocturnal representatives; and occasionally, so far as research has yet shown, no good reason can be given for nocturnal habit.

Lastly, communities of animals, like human beings, are doubtless influenced in a variety of ways; and the inherent tendency to aberration, but absolutely from physical causes not demonstrable, may act and react in a manner with which we are yet unacquainted.

ON THE DISCOVERY OF AN OSSIFEROUS CAVERN
NEAR CAPPAGH, CO. WATERFORD.

BY RICHARD J. USSHER.

THE discovery of a cave containing remains of man associated with those of Irish Elk and other animals, is an event of such interest to naturalists that no apology seems needed for bringing the particulars to the notice of the readers of 'The Zoologist.'

In April last, during a visit of Professor Leith Adams, who had on two occasions explored the Shandon cave, about five miles off, I went prospecting with him for a fresh find in my more immediate neighbourhood. We selected what proved to be a well-worn tunnel running into the face of a limestone knoll that rises some thirty feet above the general level of the valley of the Finisk River. When we commenced our digging, this cave was nearly filled to the roof, but it has since turned out to be about eight feet high, and about eight or ten wide. The first deposit we came to was dark brown earth, in which we found a broken human skull and a profusion of broken bones representing the following animals:— Ox, Goat or Sheep, Red Deer, Pig, Horse, Dog, Cat, Fox, Marten, Hare, and Rabbit. It was not surprising to find any of these, but as it shewed that the cave had long been the abode of man, or of animals that brought the bones in, we dug deeper. All the animal remains we had yet met with looked fresh and yellow, but as we dug down we came upon a stratum of peculiar grey earth, containing much carbonate of lime. In this, bones of a very different aspect turned up; blackened, ancient-looking bones, with dendritic markings, as if small snails had been coursing over them. Some of these Professor Leith Adams considered to be bones of the Irish Elk, which, he told me, had never been found *in a cave* in Ireland before. This was soon confirmed by our finding portions of the antlers of this animal, and subsequently more bones, unmistakably those of the Elk. But what had split these, especially the shin bone, which is the hardest in the skeleton and the most suitable for bone tool-makers? There it was, cleft in two, through joint and all, with flakes torn from it, and one long splinter left projecting from what remained. There was enough of this bone to show that it could have belonged to the Irish Elk alone. But it was not the only instance. With it were a number of split bones, and one which was long and rounded. This latter is not of the

natural shape of any bone, but appears to have been shaped for an awl or piercer by some ancient dweller in the cave. The groove along its side shows that it is made from the shin, probably of a Deer, and its surface is blackened like the others, one of which is the scapula of a Bear. Soon, other bones of the Bear turned up, blackened in the same way. I separated the "old bones," as we called them, with care from those in the upper stratum, and we found among the former, on examination, a human vertebra and finger-bone. The stones from this stratum were watched as they were thrown out, and, as might be expected, they afforded more indications of human occupation. Some were rounded stones broken in two, with the flat surface worn by rubbing or grinding. Others had edges more or less sharp, but chipped as if used for cutting or cleaving. Nor was this all. Throughout both these strata we found pieces of burnt wood, and about half-way down through the second stratum occurs a marked line, like an old floor, black in places with charcoal.

This, however, was not the lowest horizon inhabited by the cave-men, for, far below the black line, we found more charcoal, not only in the second stratum, but deep in that below it. Almost from the commencement of our digging we had come upon huge blocks of stalagmite of a larger size than I had ever seen before, but disconnected, as if an old floor of stalagmite had been broken up and the fragments tossed about. As we got deeper, below the two strata above-described, we found the stalagmite blocks embedded in a pale, sandy earth, forming together a third stratum. Yet even in this the charcoal appeared. Lower again, we came on a portion of the stalagmite floor that had not been broken up, but remained *in situ*. To this the crow-bar was applied. Surely, I thought, we shall find nothing here. Yet, still out of the very stalagmite itself, and from under it, we took more bones, and teeth, too; whole jaws of a large Bear, with both canine and molar teeth, the bones of his limbs and feet, vertebrae and ribs. These were of a pale buff-colour like the stalagmite, and required a glue-bath to render them durable, as they were very brittle. But we had not yet done. Under the floor of stalagmite we picked out an astragalus of Irish Elk that looks as large beside a similar bone of an Ox as a hen's egg would look beside a pigeon's; also a bone of deer, which Prof. Leith Adams suspects to be Reindeer, was found in this deep position.

Having undermined a portion of the rock on one side of the cave, we observed a cleft above it widening. We hurriedly drew back, and it was well that we had timely warning, for soon the mass tumbled down, filling the space where we had been digging. But this revealed a new object of interest. On the upper surface of this mass, which had been separated from the solid rock above by a narrow fissure, lay a bone, like the bones in stratum No. 1, certainly, from which it may have fallen into the crevice. This, on being washed, proved to be a tool with a chisel-edge, ground down on both sides. We now forsook the interior, encumbered by the fallen mass of limestone, and began turning up the soil at the entrance of the cave. We had not dug long when my friend cried out, "A celt!" picking up a dark greenish stone beautifully formed into an axe-head. There were no marks of chipping on it, but it had been carefully ground-down with the greatest regularity until it resembled the head of a small American axe, with neat edge and sides. It is four inches and a half long by two inches and five-eighths at its broadest part.

On resuming my excavations in May I found, close to this spot where lay the "celt," and in the same upper stratum, a large bead three-quarters of an inch broad and a little more than a quarter of an inch thick, but not symmetrical. When the crust of earth fell off it I found that it was transparent and of the colour of burnt sugar. It is believed to be amber. As I dug on in the cave two more worked objects were found: the first, a bone with a neatly-cut hole running through it transversely; and the other, a broken shaft like that of an arrow, only that the one remaining barb seems to point the wrong way, and seems to have been cut into at its base by string. But a more elaborately-carved article was found deeper down in a recess behind a mass of stalagmite, into which it may have fallen or been carried down like the bone chisel. This was a knife-handle, ornamented on its four smoothed sides with concentric circles, cut as if with compasses. It is hollow, and evidently held an iron blade, as it is stained with rust.

One more remark on the animal remains. As was natural in an Irish cave, we found bones of the omnipresent Pig throughout, but whether the tooth and toes which I found at a depth of seven feet, together with bones of Bear, can be dignified by the appellation of "wild boar," I must leave to others to determine.

OCCASIONAL NOTES.

BLACK RATS IN NORTH LANCASHIRE.—On the 15th and 16th of June I received four specimens of the Black Rat (*Mus rattus*), including an old female and three young ones, which had been trapped in the ship-building yard in this town. Apart from the colour (a greyish black), the extreme prolongation of the tail, ears, and nose would be sufficient to distinguish them at a glance from the ordinary brown species (*Mus decumanus*). The specimens in question have been set up, and form an interesting addition to the collection of the Barrow Naturalists' Field Club.—W. ARTHUR DURNFORD (Barrow-in-Furness).

ANECDOTE OF THE SPOTTED FLYCATCHER.—I am indebted to my friend Mr. Edward Fountaine, of Easton, Norfolk, for the relation of the following circumstance, which occurred in that parish on the 11th July:—A pair of Spotted Flycatchers had a brood of young ones in a nest built against the wall of a gentleman's house, and were, as usual, tame and familiar, and fed their young freely, undeterred by the presence of bystanders. On the day above mentioned, the gentleman I have referred to himself fed the young Flycatchers with a few flies, which they readily swallowed; but on returning to the nest a quarter of an hour later the young birds were all found on the ground, dead, and with a small hole (apparently pecked), in the head of each. One of the old Flycatchers was shortly afterwards seen at the spot with raised and ruffled feathers, and the nest was observed to be partly destroyed. This occurred about the middle of the day, when no four-footed vermin would be likely to be prowling about, and the inference seems to be that the old birds destroyed their brood in consequence of an unfeathered biped having presumed to feed them.—J. H. GURNEY (Northrepps, Norwich).

SUMMER MIGRANTS IN THE ISLE OF WIGHT.—Though comparatively few migrants have visited us this season, Nightingales have been unusually abundant, particularly in the Undercliff, to which they may have resorted for shelter, the weather having been very severe throughout the month of April. However, from the middle of April till the middle of June they were in constant song; and on the 8th of the latter month they were to be heard in all directions, more particularly at St. Lawrence, a favourite resort, the banks and terraces beneath the shelving cliffs being dotted and patched with underwood and brier, matted and overgrown with a profusion of honeysuckle, traveller's joy, and wild hop, fringed with a luxuriant growth of herbage; so that one may be within a few yards of the songster without seeing it. Not so in some parts of Kent, where they

frequent the oak woods, and may often be seen, as well as heard, perched on leafless lower branches.—HENRY HADFIELD (Ventnor, Isle of Wight).

THE SURF SCOTER IN ORKNEY.—A specimen of this handsome North American duck was obtained by me in Orkney, in February, 1876, and I believe no record of the occurrence was made in 'The Zoologist' at the time. [It was recorded in 'The Field,' 19th February, 1876.—ED.] It is well known that this bird is occasionally to be met with amongst the sounds of this group of islands, but as regards the frequency of the occurrence a good deal of uncertainty seems to exist. For part of this Messrs. Baikie and Heddle have to answer, as in their work they describe them as frequenting the sounds in small flocks during the winter. This statement has been copied by other writers, and so the error has a good chance of being perpetuated. It is, of course, a case of mistaken identity, the Velvet Scoter being the bird met with in the way mentioned. As regards the Surf duck, there can be no doubt that occasionally—I believe a careful observer would be able to say almost annually—specimens are to be met with, in some place or other, amongst the bays and channels with which this northern group is so indented. [Dr. Rae has so stated in 'The Field,' 18th March, 1876, remarking, "In the latter part of September or during October I have seen one or more in Orkney for the last ten years in the large bay which separates Kirkwall from Firth and Rendall."—ED.] Where the Velvet ducks are wont to congregate the Surf Scoter is most likely to be found, since it seems to be fond of company. [This is confirmed by Dr. Rae in the note above referred to.—ED.] A female bird might very easily escape notice; but not so the male, the white patches on head and neck render it recognisable at a considerable distance, even when surrounded by the Velvet ducks, so closely resembling it in general appearance. My own experience of the species is limited to two examples, which, however, considering the limited number of British specimens referred to in the 'Handbook of British Birds,' is a fair number to have come under the observation of one person, and makes one inclined to think that the list given might be enlarged. In addition to those which I myself saw "in the flesh," I have knowledge of two others. As to the birds to which I can refer as an eye-witness: in February, 1875, while stopping at Stromness for the purpose of collecting, I went down Hoy Sound towards the island of Bara in a yawl, knowing that the sound between it and Rysa Little was frequented from October to March by numbers of the Velvet Scoter. The first lot we fell in with consisted of four birds, just off the small semi-detached N.W. corner of the island known as the Calf of Bara. On getting near I saw a white-headed bird amongst them, which I at first took for a Long-tailed Duck, *Harelda glacialis*, which also frequents this sound; but soon there was no mistaking the bird's identity—it was an adult male Surf Scoter. We sailed up within thirty yards before the birds

took wing, the stranger seeming particularly tame, and being the last to leave the water, affording as it did so an easy cross-shot. It fell to my first barrel, but instantly diving came up astern of the yawl, and flew off as though not touched; the second barrel also had no effect in stopping its career. The boatman and I watched its flight, nevertheless, and both saw it fall with a splash about a third of a mile away, but on getting to the spot, which we were not long doing, could see no more of it, although the water under the lee of Rysa was as smooth as glass; nor could I hear any more of it during the time I was then in Orkney. In February of the next year, 1876, I was at Stromness again, and the first fine day,—which rarely occurs in an Orkney winter,—the tides suiting, I started again down the sound of Hoy to see if another North American stranger should chance to be amongst the Velvet ducks. This time I took the precaution of towing down a gunning-punt astern of the yawl, with a hundred-pound gun, feeling considerable distrust of the powers of a small gun to stop such a tough customer as I had met with the previous year. I was again fortunate enough to find one, within half a mile of the place where the former bird had occurred. About a dozen Velvet ducks were swimming in a bay formed by the island of Rysa, and on approaching these with the punt I found a Surf Scoter in company with them. On getting up within shot this bird separated itself from the rest, and as it seemed very tame, and the big gun was turned full on it, affording little chance for escape, even if it suddenly rose, which the Scoter has a difficulty in doing. I watched it a bit from the punt before pulling the trigger-line. The flock of Scoters were now some distance away, when one of the birds left the others and swam rapidly towards the Surf duck; thinking this might be a female, I waited for the birds to get in line, and fired just before they crossed. When the smoke cleared one bird was floating dead upon the surface, and almost immediately the other came up from a dive and flew off. I was afraid at first that last year's misfortune had been repeated, but on getting up to the dead bird I had the pleasure of picking up an adult male Surf Scoter, in most perfect plumage. It had luckily escaped much damage from the storm of shot (17 oz.) from the punt-gun, a single pellet having passed through the lower portion of the elongated white patch on the nape of the neck. I felt less surprise at the failure of my small gun on handling the wonderfully thick soft and velvet-like plumage. As for the other two specimens I heard about in Orkney, one of them is in the museum at Stromness, in a most miserable state of preservation, having suffered severely from moth and damp. In fact, had I not been expressly told to look out for a Surf Scoter, I might easily have passed it over without notice; nor is its history very satisfactory, an uncertainty existing as to the place in which the bird was obtained. I should scarcely have made mention of this bird had not the late Mr. Joseph Dunn assured me that the birds in the museum were all local specimens, and

that he had no doubt of this one having been obtained in the vicinity, but he could say nothing definite about it. The authenticity of the remaining bird, however, is undoubted, Mr. Dunn having shot it himself very near the same spot in which my two specimens were met with. I questioned him closely concerning the occurrence of these birds amongst the Orkney group, knowing what an experience he had had there. He was always very careful in his ornithological statements, and in this case contented himself with declaring that he had only got that one specimen during his long residence at Stromness; he might have seen others,—in fact, he hinted that he did see them occasionally, but preferred to make positive mention only of the one he had actually obtained; he appeared to think these birds very wild and difficult to get within shot of, my experience in this respect conflicting with his, the two I met with being particularly tame. In addition I made enquiry of the boatmen who live on the low eastern end of Hoy—locally known as “Walls”—bordering on the sound of Fara, a spot much frequented by the Velvet ducks. These men declared that amongst the black ducks they occasionally see a strange-looking one with a white head, but “not every year.” The year following I was again in Orkney, but saw no Surf-duck, the weather being so unfavourable that during six weeks’ stay I was only able to get down to Bara once. Since that time I have heard every year from the Stromness boatman, James Sutherland, who was with me on the two occasions, and who accompanies any accidental visitors to that town intent on sporting, but he has never since that time seen a similar bird; his visits, however, would probably be limited to two or three annual trips,—scarcely a fair trial of the question,—and there are several other localities in Orkney quite as likely to reward a search—notably so some of the water to the northward of Kirkwall. On the whole I am inclined to believe that the Surf Scoter not very unfrequently (if not every year) pays visits to the Orkneys.—T. M. PIKE (Malvern).

[In addition to the specimens referred to by Mr. Pike as recorded in the ‘Handbook of British Birds’ (twelve in number), and to those now mentioned by him, may be noticed two others recorded by Capt. Clark-Kennedy in ‘The Field’ of March 11th, 1876, one of which was obtained at Longhope, Hoy Island, in 1872, and the other at the Brig of Waithe, at the entrance of Loch Stennis, Stromness.—ED.]

EARLY MENTION OF THE HOOPOE AS A BRITISH BIRD (A. D. 1395).—Amongst the documents preserved in the muniment room of Merton College, Oxford, is “An Account of the Charges incurred at the Determination Feast of Richard, son of Thomas Holand, half-brother of Richard II., in February, 1395.” From internal evidence it would appear that the feast was conducted by the University. In this curious document an inventory is furnished of the bread and meat, poultry, game and other birds, purchased

for the occasion, and the prices paid for the same. Under the heading “*Empecio poltriae et volatilium*,” we read:—“Et in v. gallinis emptis, pretium capitis ijd., xd. Et in iij duodenis caponum emptis pretium xij^{ae} ijs. ixs. Et in iiij xij^{is} de anatibus emptis pretium xij^{ae} ijs. viijd. Et in diversis volatilibus in grosso per diversas vices, vs. Et in xxijj gastrimargiis [sc. Woodcocks] emptis pretium capitis ijd., vjs. vijd. Et in duobus perdicibus emptis pretium capitis ijd. ob vjd. Et in iij malards et iiij teles emptis xxjd. Et in xijj plovers emptis pretium capitis ijd., ijs. vjd. Et in xlvj perdicibus emptis xjs. ixjd. pretium perdieis iij ob. Et in vij *upupis* [sc. Hoopoes] emptis pretium capitis ijd., xijjd. Et in xvij snytes emptis in grosso, xijd. Et in xx. xij^{is} avium, viz. owseles, thresshes, et feldefares, xs. Et in avibus emptis xd. Et in xxijj snytes emptis in grosso xvjd. Et in v anatibus de ryver [sc. ‘wild-ducks’ as distinguished from the tame birds above referred to] emptis xvjd. Et in iij duodenis avium et v perdicibus emptis xxjd. Et in xxijj perdieibus emptis de uno homine de Sare. pretium capitis ijd., iiijs. Summa.”

The document from which this extract is taken—a curious jumble of Latin, French, and English—has been printed by Professor Thorold-Rogers at the end of the second volume of his ‘History of Agriculture and Prices in England’ (pp. 643-647). If the word “*upupis*” be intended to apply to the Hoopoe (*Upupa epops*),—and I know not to what other species it could be applied (the price paid precluding the idea that the writer confounded the name “Hooper” with “Hoopoe”),—it is remarkable that these birds were so common in England in 1395, that as many as seven might be obtained at one time for twopence apiece. The month of February, too, strikes one as being an unusual time of year at which to find them here, although a few other instances are known of their occurrence here in winter. They fetched the same price apparently as fowls, and were cheaper than woodcocks. What their gastronomic properties may be I am unable to say, but from what I have observed abroad of their habits and the nature of their food, I should not have expected to find them set down amongst “the delicacies of the season.”—J. E. HARTING.

NESTING OF THE STOCK DOVE.—I think the habit of nesting early in this bird has somewhat escaped the notice of ornithologists. About the second week in March they may be seen performing the prettiest aerial movements possible in the vicinity of their nesting-haunts. They keep flying round and round in circles, generally at the beginning of the flight, rising up perpendicularly in the air at an altitude of several feet from their favourite perch, smartly striking the wings together with a loud clap, which can be heard a considerable distance. Often by the second week in April, or by the beginning of the third week, the young ones are fledged, as was the case this spring, though one of unusual severity. The nest is generally

placed in a hole in a tree, but other situations are occasionally fixed on; I have found it exposed to the air on the top of pollard-ash and willow trees. I once met with this species nesting on the floor in a belfry; there were two or three nests in close proximity to the bells; and the late Mr. J. J. Briggs found them building underneath the railway-bridges overspanning the Trent. They will also nest in rabbit-burrows, and Mr. Harting discovered them nidifying in cliffs facing the sea ('The Field,' 14th April, 1866, and 'Birds of Middlesex,' p. 134, *note*), and other observers have testified likewise. The nest of the Stock Dove, however, may also be met with very late in the season; I found two fresh eggs in a hollow ash tree on the 2nd October, 1875. I am informed, on good authority, by a collector, that he has found this bird's eggs inside a deserted Magpie's nest. I have noticed the Stock Dove as plentiful in Lincolnshire, Nottinghamshire, Bedfordshire, Buckinghamshire, and Oxfordshire. It breeds abundantly in all five counties, and may often be called common.—C. MATTHEW PRIOR (The Avenue, Bedford).

[During the summer of 1865 a pair of Stock Doves nested in the belfry of the old church at Kingsbury. The following summer they returned and again had a nest there. We secured the young and reared them in an aviary, that the identification of the species might be placed beyond doubt. The details will be found recorded in 'The Ibis' for 1867, p. 380.—ED.]

GULLS BREEDING IN WESTMORELAND.—It is perhaps not generally known that a considerable number of Lesser Black-backed and Herring Gulls (*Larus fuscus* and *L. argentatus*) breed regularly on Foulshaw Moss, near Arnside. Twenty years ago the colony was of small dimensions, the nests being placed, comparatively speaking, close together. Since that time, owing apparently to all the eggs having been taken on one occasion, the birds have spread out over an area of several hundred acres, and, having in the meantime largely increased in numbers, there are probably at present not less than two or three hundred broods of young birds. The eggs were laid this year about May 24th, a week or two later than usual. The Lesser Black-backed birds seem to exceed the Herring Gulls in the proportion of nearly ten to one. The most noteworthy fact in connection with these Gulls is the immense havoc they cause amongst the fish in the neighbouring river, the Kent. Young salmon and sea-trout up to a couple of pounds or more in weight fall victims to their attacks in large numbers; and the remains of these, as well as of crabs, shell-fish, &c., which strew the moss in the vicinity of the nests, testify to their extreme voracity. The Grouse, which are tolerably plentiful in the locality, are being gradually expelled from their original haunts, and, though it does not seem to have been proved that the Gulls will actually devour the young birds (possibly the resemblance to their own progeny would prevent this),

if nothing is done to check the increase of these depredations in the future, the moss will eventually cease to be of much value for sporting purposes. In addition to the Gulls and Grouse, Wild Ducks, Teal, Curlews and Snipe breed on the moss; and a short distance off, across the river, is a good-sized heronry. It is scarcely necessary to add that all these birds are carefully preserved by the owner of the property.—W. ARTHUR DURNFORD (Barrow-in-Furness).

THE GREAT BUSTARD FORMERLY IN LINCOLNSHIRE.—We learn from Mr. Cordeaux's 'Birds of the Humber District' (pp. 83-85) that the Great Bustard, "formerly inhabiting the desolate wolds of Lincolnshire and Yorkshire, has passed away, leaving in the former county scarcely a tradition of its presence." One such tradition, if it may be so called, has been preserved in a book where one would least expect to find it,—namely, in Boswell's 'Life of Johnson,'—and as Mr. Cordeaux has not referred to this notice in his remarks on Lincolnshire Bustards, I will quote the passage to which I allude. It occurs in a letter dated 9th January, 1758, addressed by Dr. Johnson to his friend Bennet Langton, of Langton, near Wragby, and runs as follows:—"I have left off housekeeping, and therefore made presents of the game which you were pleased to send me. The Pheasant I gave to Mr. Richardson [the author of 'Clarissa'], the Bustard to Dr. Lawrence, and the pot I placed with Miss Williams, to be eaten by myself." This "game," then, was sent up to London from Langton, and, considering what the aspect of that part of Lincolnshire was at the date mentioned, the difficulties of communication, and the mode of conveyance in those days, it cannot be doubted that this Bustard, like the Pheasant, must have been killed in the neighbourhood in which the sender resided. Whether it is quite justifiable to identify the bird so called with the Great Bustard may be a question, although the probability is that this view is correct, since the smaller species has been almost invariably distinguished as the Little Bustard, while in contemporary and other notices where reference is made to "*the Bustard*" the context shows, either from the description given of plumage, size, or weight, or from some allusion to its habits, that the Great Bustard was the bird intended. I learn from Mr. Cordeaux that Wragby lies between the oolite and the chalk, on both of which ranges the Great Bustard was at one time probably not uncommon.—J. E. HARTING.

Migration of House Martins.—My own observations quite coincide with those of Mr. Stevenson as to the early migration of the main body of House Martins. Although contrary to what might at first be expected, their departure does not take place in this county until about the second week in September. On reference to my note-books I find that the first, and as I think, the main migratory flight departed, in 1875, on September

13th; in 1876, on September 12th. I have unfortunately lost the date for 1877, but am almost certain it was either on the 6th or 7th of September; and in 1878 on the 11th of September. For a few days previous to their departure they collect in great numbers on a projection in front of the Wesleyan Chapel, which has been a rendezvous for these birds for a number of years. On the morning of their migration they are very active; preening themselves, and performing short flights until they rise almost simultaneously for their final voyage. They fly, at a moderate height, in a south-easterly direction.—E. P. P. BUTTERFIELD (Wilsden).

BARN OWLS AND SHREW MICE.—The Barn Owl, it is generally supposed, never preys upon Shrew Mice, but on clearing out an old nesting-hole, last August, I was surprised to find among the skulls of other mice, hundreds of those of the Shrew. Many of the pellets were composed mainly of the skulls of House Sparrows, and I failed to detect the remains of any other bird. The young, when taken from the nest, thrived, and fed greedily on any sort of fish, when meat was not forthcoming. I fancy if more attention was given to the castings of Barn Owls, we should often find the Shrew in the bill of fare.—C. MATTHEW PRIOR (Bedford).

[On dissolving in warm water four pellets of the Barn Owl forwarded by our correspondent, we discovered the crania, more or less perfect, of nine mice and three shrews; nine pairs of lower jaws of mice; three pairs of lower jaws of shrews; besides fragments of the leg-bones and shoulder-blades of a corresponding number of these little animals. No remains of birds.—ED.]

WOOD WREN IN THE COUNTY OF WICKLOW.—In the month of June last, while staying at the Glendalough Hotel, I made it my object to search carefully for the Wood Wren in the oak plantations of Derrybawn, where I had previously observed the bird during three different summers. Having visited its haunts daily from the 1st of June I did not observe it until the 9th, when a couple of pairs made their appearance, and I have now little doubt that the bird breeds annually in this locality.—H. CHICHESTER HART (7, St. Stephen's Green, Dublin).

GOLDEN ORIOLE IN SUFFOLK.—At the end of May last Mr. T. C. Ellis, of Oxnead Lodge, Newmarket Road, in this city, while driving from Sudbury to Newton, saw a fine male Golden Oriole fly from a tall hedge by the roadside. He was particularly struck with the brilliancy of its colour, and from the description he gave me and his recognizing a specimen in my shop-window, there can scarcely be a doubt of its occurrence as stated.—T. E. GUNN (St. Giles Street, Norwich).

NESTING HABITS OF THE STARLING.—With reference to the remark I made relative to the Starling rearing but one brood in a season (p. 187),

I did not mean to imply that occasionally they may not rear two broods, but that these bear but a small proportion to the number which only rear one brood. It is an interesting sight to see them hurrying to and from their nests at the end of May, especially near such breeding-haunts as Eastby rocks, where every available space is occupied by a Starling's nest. All is animation. It reminds one of being in the vicinity of a wasp's nest. How is it that, if they rear two broods, we never discover the same activity on subsequently visiting their haunts? Even of the few that have young in July it is very probable that some may have had their first nest destroyed; but this remark applies with greater force to such nests as are built about our residences.—E. P. P. BUTTERFIELD (Wilsden).

SWORD-FISH ON THE NORFOLK COAST.—A specimen of the Sword-fish, *Xiphias gladius*, was captured off Sheringham, on the coast of Norfolk, in a mackerel-net, on July 14th. It measured 9 feet 6 inches from tip to tip, including the "sword," the length of which was 3 feet.—J. H. GURNEY (Northrepps, Norwich).

BOAR-FISH AT THE MOUTH OF THE HUMBER.—I have a dried example of this fish, which was captured in 1877 off the mouth of the Humber and brought alive into Grimsby. In its present condition it measures 5½ inches in length by 2½ in depth in front of the first dorsal. This is probably the most northern occurrence of the species on the British coast.—JOHN CORDEAUX (Great Cotes, Ulceby).

OCCURRENCE OF THE BOAR-FISH.—During the month of June last I received several notices of the occurrence of the Boar-fish (*Capros aper*) from various parts of the south and south-east coasts of England. First from Bournemouth and Weymouth, where they were found, not uncommonly, dead on the shore. Again, one of the Leigh "shrimpers" took about a dozen specimens in his trawl-net near Sheerness at the mouth of the Thames. Another haul of two specimens was made likewise in a shrimp-trawl off Harwich. None of these survived, no doubt having been too long in the trawl. Dead specimens of these were sent for me to look at by Mr. Andrew, the Aquarium fish-collector, of 25, Cambridge Terrace, Southend. He says the Essex fishermen know them as "Red Dorees," but none remember having seen them on that coast before this year.—JOHN T. CARRINGTON (Royal Aquarium, Westminster, S.W.)

MONSTER BREAM IN NORFOLK.—A monster Bream, weighing upwards of 11½ lbs., was caught in a pond at Beeston Regis, near Cromer, on the 17th June, by Mr. J. W. Cremer. It was a male fish and very dark in colour; in total length it measured, from tip of nose to fork of tail, 26 inches;

depth, 10 inches; girth, 23 inches. This is the largest specimen of the common Bream that I ever saw or heard of occurring in England. A fine specimen was also caught by Mr. Harper in the River Yare at Thorpe, Norwich, on the 23rd June, with an ordinary line and aid of landing-net. This fish weighed $8\frac{3}{4}$ lbs., and measured 23 inches in length and $19\frac{1}{2}$ inches in girth. Both the above were sent me, and are in course of preservation. The last-mentioned specimen was a female, and after being landed in the boat voided a large quantity of ova. — T. E. GUNN (St. Giles Street, Norwich).

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

LINNEAN SOCIETY OF LONDON.

June 5, 1879.—Prof. ALLMAN, F.R.S., President, in the chair.

Mr. A. D. Michael was elected a Fellow of the Society.

Prof. W. K. Parker read an abstract of a lengthened memoir "On the Structure and Development of the Skull in the Urodelous Amphibia." In this memoir several common and rare forms are worked out, the Spotted Salamander serving as a type. It is noticed that some of the so-called "skin bones" appear early, others of the investing bones appear later, and the investing cartilaginous roof of the nose comes after the ear-capsule cartilages. Some *Woodela* show a stapes which notably is absent in *Ceratodus* and *Lepidosiren*. The transformations of the *Anoura* are carried on in the plastic larva and young to a greater extent than in the *Urodelae*. "There have not been wanting anatomists," says Mr. Parker, "who, failing from deficient embryological knowledge to see the meaning of this or that part, have trusted to teleological explanations, but teleological science belonging to another category of research of thought thus used becomes a misleading light—an *ignis fatuus*."

The more important portions of a fourth "Contribution to the Mollusca of the 'Challenger' Expedition," by the Rev. R. Boog Watson, was read by the Secretary, in the absence of the author. This deals with the *Trochidae* and *Turbinidae*. A new species of *Basilissa* (*B. oxytropis*) is also described, accident preventing its being included in the previous list. Of the *Trochus* group, the *Margarita* are many of them remarkable for beauty and for form. Of the genus *Turbo* there are few, but one species is of extraordinary beauty. The author states that the list of known species presents no such features of interest as to call for its publication at present. Here follows the diagnosis and lengthened description of *Basilissa* (one species), *Trochus* (sixteen species), and *Turbo* (three species). All now communicated are new to science. Some are from deep water, and shed light on a faunal zone not yet familiar to us.

June 19, 1879.—Prof. ALLMAN, F.R.S., President, in the chair.

Mr. Charles Holmes, of Bradford, was elected a Fellow of the Society.

The President called attention to two volumes folio 'On the British Fresh-water Fishes,' by the Rev. W. Houghton. These, recently issued, illustrate in colours all the known species, and the work forms a handsome addition to the literature of the British fauna.

The Secretary, in the absence of the author, then read a paper "On a remarkable branched *Syllis* from the 'Challenger' Expedition," by Dr. W. C. M'Intosh. This polychæte worm, *S. ramosa*, was found in the basal canals of a hexactinellid sponge dredged near Zebu, Philippines. Thread-like in thickness, the branches are intricately arranged among the meshes of the sponge, and it appears that but one head must serve for many branches. Buds and secondary buds are very numerous on the latter, and in a free female pedal bristle-tufts were observed. A fragment of a different form is suggested as possibly the male of the foregoing rare example of a truly branched annelid. They both differ in most particulars from anything heretofore recorded in science.

"On the Thorax of the Blow-fly," was the title of a paper by Mr. A. Hammond. Most authorities at present recognise the great preponderance of the mesothorax over the other two segments (prothorax and metathorax), but do not fix the limit of each. The author refers to the integumentary parts entering into the thorax of insects, as enumerated by Audouin, and also especially to the views held by Westwood, Burmeister, Lowne, and others. Afterwards he gives a full description of his own dissections and preparations, and reasons for dissenting from the majority of workers, though with evident inclination to Audouin's opinions. He concludes that, from the analogy presented by other insects, from the evidence derivable from the phenomena of developmental change, and from a study and consideration of the nervous muscular systems, all combine to show that the thorax of Diptera, as illustrated in the blow-fly, is almost exclusively mesothoracic; this conviction, be it observed, being quite at variance with that promulgated by Lowne in his admirable researches on the blow-fly.

Mr. G. Busk read a communication "On Recent Species of *Heteropora*," this being founded chiefly on material got by the 'Challenger' Expedition. Hitherto our knowledge of these Polyzoa has been derived from fossil forms, but quite lately Mr. Waters has drawn attention to a recent example in the British Museum Collection, said to be from Japan. Mr. Busk now considerably adds to our information on the living types, and enters into an account of the several structural peculiarities observed by him.

Then followed a paper by Pastor H. D. J. Wallengren, of Sweden, "On the Species of Caddis-flies (*Phryganea*) described by Linnæus in his 'Fauna Suecica,' with Notes thereon," communicated by Mr. R. M'Lachlan.

A paper "On the Bell-bird," by Dr. J. Murie, was taken as read.

ZOOLOGICAL SOCIETY OF LONDON.

June 17, 1879.—Professor W. H. FLOWER, LL.D., F.R.S., President, in the chair.

The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of May, 1879, and called special attention to several novelties, amongst which were:—two Horned Parrakeets, *Nymphicus cornutus*, obtained by purchase; a Hornbill, received in exchange May 8th, which appeared to be a second example of the species described in 1870 as *Buceros subcylindricus*; a young male Patagonian Sea-lion, *Otaria jubata*, presented by Mr. F. E. Cobb, Manager of the Falkland Islands Company, at Stanley, Falkland Islands; and a Saki Monkey, *Brachyurus rubicundus*, purchased May 24th, new to the Society's Collection.

Mr. Sclater exhibited a skin of *Ara glauca*, from Mr. Boucard's collection, obtained at Corrientes, and stated that having compared it with the *Ara* now in the Gardens, purchased in June, 1860, and hitherto named *A. glauca*, he had come to the conclusion that the living bird belonged to the allied form, *Ara Leari*.

Prof. Flower called attention to the skull of the female Sea-lion, which had lately died at the Southport Aquarium, and pointed out that it belonged to *Otaria Gillespii*, and not, as had been supposed, to *Otaria Stelleri*.

Mr. C. G. Danford exhibited and made remarks on some remarkable antlers of Deer, which he had obtained during his recent journey in Asia Minor.

Prof. Newton exhibited skins of some rare species of birds obtained by Mr. Edward Newton, in Jamaica.

Mr. F. D. Godman exhibited and made remarks on a drawing of the Manatee by Mr. Wolf, taken from the specimen lately living in the Westminster Aquarium.

Hans Graf von Berlepsch exhibited and made remarks on the skins of two varieties of the Long-tailed Titmouse, *Mecistura caudata*, which occurred near Cassel, in Germany, one of which appeared to be the same as the British form of this bird.

Dr. J. Murie read a paper on the Manatee, containing the results of his examination of the specimen which was lately living in the Westminster Aquarium. The peculiar attitudes assumed by the animal in life, the great mobility of the upper lip, and the occasional use of the limbs in feeding were noted. As regards the anatomy, the chief points dwelt on were the shape of the brain and its suppressed convolutions. The vexed question of the number of the cervical nerves and their distribution was also discussed.

A communication was read from Mr. A. H. Garrod, on the brain and on other points in the structure of the adult male Hippopotamus, which was presented to the Society by the late Viceroy of Egypt in 1850, and which died in the Society's Gardens in March, 1878.

A second communication from Mr. Garrod contained a note on the mechanism of respiration, as well as of the retraction of the head and limbs in certain Chelonia.

Dr. Gwyn Jeffreys communicated the second part of his work on the Mollusca of the 'Lightning' and 'Porcupine' Expeditions, embracing the families from *Anomiidae* to *Arcidae*. The number of species noticed was 100, of which four were new to science, and fifteen were hitherto unfigured. Particulars were given of the geographical and geological distribution of all the species, and their synonymy was discussed. Some species of *Leda* and *Malletia* were Sicilian fossils of the pliocene formation, and had not been previously known as recent or living. These species occurred at great depths, a fact which showed that the sea-bed in that part of the Mediterranean had been considerably raised since the tertiary epoch.

Mr. Edward R. Alston read a note on the *Acanthomys leucopus* of Gray, showing that it does not belong to the genus *Acanthomys*, but to *Mus* proper. As the name *leucopus* is pre-occupied in the latter genus, he proposed to call the species *Mus terræ-reginae*.

Mr. W. L. Distant read a paper on the African species of Lepidoptera of the genus *Papilio*. A new species from Magila, East Africa, was described, and the name of *Papilio Hornimani* was proposed for it.

A communication was read from the Count T. Salvadori, containing further particulars of the new Pheasant from Western Sumatra which he had recently described as *Acomus inornatus*.

Messrs. Godman and Salvin gave an account of some hitherto unrecorded diurnal Lepidoptera, obtained by the Rev. George Brown in Duke of York Island and New Ireland, together with descriptions of some apparently new species.

A communication was read from Mr. F. Jeffrey Bell, being the second of the series of his observations on the characters of *Echinoidea*. The present paper contained an account of the species of the genus *Tripneustes*.

Messrs. Selater and Salvin read a paper on the birds of Bolivia, based principally upon an examination of the specimens obtained by Mr. Buckley during two expeditions into that country.

This Meeting closes the present Session. There will be no more Scientific Meetings until the commencement of the next Session, 1879-80, in November next.—P. S. SCLATER, *Secretary*.

ENTOMOLOGICAL SOCIETY OF LONDON.

June 4, 1879.—H. W. BATES, F.L.S., F.Z.S., Vice-President, in the chair.

Donations to the Library were announced, and thanks voted to donors.

Mr. J. Walhouse, F.R.A.S., of 9, Randolph Crescent, Maida Vale, was ballotted for and elected an Ordinary Member. Senor Antonio Augusto de Carvatho Monteiro, 72, Rua do Alecrion, Lisbon, was ballotted for and elected a Foreign Member. Mr. C. H. Goodman, of Kearsbrook Lodge, Lesness Heath, Kent, was ballotted for and elected a Subscriber.

Mr. M'Lachlan called attention to a notice by Prof. F. A. Forel, published in the 'Procès-Verbaux de la Société Vaudoise des Sciences Naturelles' (séance du 5 Decembre, 1877), concerning certain sculptured markings on cretaceous pebbles from the shores of Lac Léman. Various theories had been propounded to explain the cause of those markings, such as the action of Algæ, Mollusca, &c. Prof. Forel had, however, come to the conclusion that they were mainly due to the action of larvæ of Trichoptera, which formed galleries over the surface, and there were larger and deeper depressions in the places where the cases were fixed. Mr. M'Lachlan had received from Prof. Forel, through Capt. Marshall Hall, certain of these larvæ in alcohol, and two plaster casts of small blocks (exhibited), one of Jurassic limestone, the other of ordinary white chalk, the latter being one of several placed in the lake by Prof. Forel on the 12th March, and taken out on the 26th November following, and on which he had scratched his initials; these scratches had been deepened in some places by the action of the larvæ, which apparently were those of the genus *Philopotamus* in the family *Hydropsychidae*.

Mr. Meldola suggested that the depressions in the pieces of chalk and limestone might have been produced by the solvent action of the water charged with carbonic acid, which issued from the galleries of the larvæ, a circulation of oxygenated water being necessary for their respiration, and after being used for this purpose the effluent water would naturally contain more carbonic acid than before its entry into the galleries; but this explanation would not hold good if the casts themselves had been directly acted upon by the larvæ.

Mr. J. S. Baly communicated a paper entitled "An Attempt to point out the Differential Characters of some closely-allied Species of *Chrysomela*, chiefly those contained in Suffrian's 11th group; also Descriptions of some hitherto uncharacterised forms belonging to the same and other Genera of the Family."

Prof. Westwood communicated two papers, entitled "A Decade of new *Cetoniidae*," and "On some unusual Monstrous Insects."

Mr. W. L. Distant read a paper entitled "Contributions to our Knowledge of the Hemipterous Fauna of Madagascar."

Sir Sidney Saunders communicated some notes from M. Jules Lichtenstein, of Montpellier, describing the metamorphoses of the blister-beetle, which, after repeated failures for many years, he had recently succeeded in rearing from the egg.

Mr. Meldola communicated a translation of a paper by Dr. Fritz Müller, published in 'Kosmos,' May, 1879, and entitled " *Ituna* and *Thyridia*; a remarkable case of Mimicry in Butterflies."

With reference to Dr. Fritz Müller's remarks on the inexperience of young birds, Mr. Jenner Weir stated that from the numerous experiments which he had made on the subject of larvæ which are eaten or rejected, he had always been profoundly impressed with the utter disregard paid by birds to larvæ which were inedible. He had never but once seen a distasteful larva even examined by a bird. When, day by day, he had thrown into his aviary various larvæ, those which were edible were eaten immediately; those which were inedible were no more noticed than if a pebble had been thrown before the birds. It was Mr. Weir's opinion that the experience of birds in this respect had become hereditary in the species, and was not the result of the experience of individual birds, but was rather to be regarded as an act of "unconscious cerebration."

Mr. Bates, whilst acknowledging the great value of the numerous facts adduced from his own personal observation by Dr. Fritz Müller, could not agree with him in his proposal to separate, as a distinct family, *Ituna* and *Lycorea* (with *Danais*) from *Thyridia* and the remainder of the *Ithomiæ* group; the characters mentioned by him only went to prove that *Ituna* and *Lycorea* were the connecting links between *Danais* and the *Ithomiæ*, thus justifying the views of those Lepidopterists who first defined this important group nearly twenty years ago. With regard to the still incompletely solved problem of mimicry, he could not see that Dr. Müller's explanations and calculations cleared up all the difficulties. The numerous cases where species which are themselves apparently protected by their offensive secretions evidently mimic other species similarly protected still form a great stumbling-block. The excessive complexity of the question must be evident to all who read Dr. Fritz Müller's writings on this subject. The phenomena with regard to the *Heliconidæ*, stated broadly, were these:—In Tropical South America a numerous series of gaily-coloured butterflies and moths, of very different families, which occur in abundance in almost every locality a naturalist may visit, are found all to change their hues and markings together, as if by the touch of an enchanter's wand, at every few hundred miles, the distances being shorter near the eastern slopes of the Andes than nearer the Atlantic. So close is the accord of some half dozen species (of widely different genera) in each change that he (Mr. Bates) had seen them in large collections classed and named respectively as one species. Such a phenomenon was calculated to excite

the interest of the travelling naturalist in the highest degree. Although the accordant changes were generally complete, cases occurred in which intermediate varieties were still extant, and the study of these had given him, when he was in South America, the clue to an explanation which, however, does not embrace the whole of the problem.

July 2, 1879.—Sir JOHN LUBBOCK, Bart., M.P., V.-P.R.S., President, in the chair.

Donations to the Library were announced, and thanks voted to donors.

Mr. Vincent Robert Perkins, of 54, Gloucester Street, South Belgravia, was ballotted for and elected an ordinary Member.

Mr. S. Stevens exhibited living specimens of *Tillus unifasciatus* and *Teretrius picipes*, from the same fence, at Norwood, where these insects were captured last year, this being the fourth season of capturing the first, and the third season of taking the second species in this locality. (See also Proc. Ent. Soc., 1878, p. xli).

Mr. M'Lachlan made a further communication respecting the sculptured pebbles from Lac Léman. He had received from Prof. Forel an actual water-worn limestone pebble from the lake, which did not, however, show any distinct sculpturing, but on it were the covered channels formed by Trichopterous larvæ. A number of the perfect insects forwarded (with larvæ and pupæ) by Prof. Forel proved to be *Tinodes lurida*, Curt., a common insect generally on the margins of lakes and rivers.

Mr. W. L. Distant exhibited a specimen of *Papilio Hystaspes*, Feld., taken by Mr. R. E. Cole at sea during a calm, thirty miles from Singapore and nine miles from the nearest land. This butterfly, found both at the Philippine Isles and Malacca, is generally considered as a variety or local race of *Papilio Helenus*, Linn., round which are also grouped a number of other closely allied forms. Mr. Distant suggested that if, as in this case, one of these forms could be found so far at sea during a calm, it could easily be realized how in such a region of sudden storms involuntary migration must frequently take place, and the differences in the conditions of the new habitats might be sufficient to produce the many constant but varietal forms of this species.

Mr. William Cole exhibited a remarkable variety of *Pyrameis cardui*, taken at Buckhurst Hill, Essex, in June.

The Secretary exhibited, on the part of Lord Walsingham, some specimens of a species of Tipulidæ (*Bittacomorpha clavipes*, Fabr.), remarkable for possessing greatly enlarged tarsal joints, captured at Pitt River, California.

Sir Sidney Saunders communicated some additional explanation, received from M. Jules Lichtenstein, of Montpellier, respecting the rearing of the blister-beetle, *Cantharis vesicatoria*.—R. MELDOLA, Hon. Secretary.

NOTICES OF NEW BOOKS.

The Wild White Cattle of Great Britain: an Account of their Origin, History, and Present State. By the late Rev. JOHN STORRER, M.A., of Hellidon, Northamptonshire. Edited by his Son, JOHN STORRER. 8vo, pp. 378. London: Cassell, Petter and Galpin. 1879.

CONSIDERING the antiquity of the race of Wild White Cattle, a few herds of which still survive in England and Scotland, and the interest which attaches to their origin and history, it is somewhat surprising that, until the appearance of the present volume, nothing like a complete account of them had been published.

It is true that various allusions to the primitive race of wild cattle in the British Islands may be found in the works of the older historians, as FitzStephen, Hector Boece, Leslie, and Sibbald; the question of their origin and affinities has furnished a theme for several eminent palaeontologists, as Professors Nilsson and Rütemeyer, Sir Charles Lyell, Dr. J. A. Smith, and Prof. Boyd Dawkins; while accounts of particular herds may be found in the works of various antiquarians and county historians, amongst whom we find such well-known names as Leland, Erdeswick, Leigh, Raine, and Whittaker. Nor have naturalists at various times omitted to notice them, as testified by the works of Pennant, Bewick, Bell, and Mr. Darwin. But the earlier references, generally speaking, are vague and unsatisfactory, chiefly because founded upon hearsay evidence; while the later accounts, although in many cases extremely valuable, are more or less fragmentary and incomplete in their nature, necessitating careful consideration and comparison before one can proceed to generalize from them.

It devolved upon the late Mr. Storrer, from these and other sources, to collect and arrange all such information concerning wild cattle in Great Britain as seemed to him reliable and trustworthy, and the result is now given to the world in the book before us.

If the arrangement of the material at his command is not so good as it might have been, this doubtless must be attributed not so much to the inability of the author to deal with his facts, as to the regrettable circumstance of his demise before the completion of his labours. Under the *nom-de-plume* of "Historicus," the late Mr. Storrer was well known as an experienced writer on the various breeds of domestic cattle, particularly "Short-horns," and his opinions were always received with deference by those who claimed with him to be authorities on the subject. Had he lived to complete the present work, it may be assumed that in several respects it would have been materially improved. "The text of the book," says the editor (his son), "has been left by me in all respects as Mr. Storrer left it, with the sole exception of a few merely verbal corrections. A few notes it seemed well to add are carefully distinguished. In every case I have been most particular to preserve the exact meaning of the author, even to the minutest shade." In this respect, we think, the editor has exercised a wise discretion.

Commencing with an examination of the questions affecting the origin of cattle, the European races, and the fossil species, the author investigates the history of the Urus in ancient Britain, and the early notices which he has met with of wild cattle in England and Scotland. Passing from forest to park, he dwells on the gradual extinction of wild animals in forests, while, owing to the protection afforded them, they still survive in parks, and quotes such authors as have contributed to a history of so-called wild cattle in the semi-domesticated state. To the Chillingham herd no less than four chapters are devoted,—doubtless because it has been noticed by previous writers more than any other, and after dealing less fully with the herds of Chartley, Lyme Park, Burton Constable, Somerford, Wollaton, Gisburne, Middleton, and Gunton Park, he passes on to a consideration of the extinct and existing Scottish herds, and, in an "Appendix," gives a list of localities where wild white cattle or their domestic descendants are (in his opinion) proved to have existed.

This list is a long one; much longer, indeed, than most people would suppose. In Scotland alone eleven places are named as having at one time harboured wild cattle, although in

two only (Cadzow and Kilmory) are herds to be found at the present day.

In England, evidence more or less convincing is adduced to show the former existence of wild cattle, or herds in parks, in twenty-eight different places, in all of which, save three, they have either died out (Mr. Storrer thinks from too closely interbreeding) or have been purposely destroyed. But in addition to the three parks which are now generally known to contain herds, *viz.*, Chillingham, Chartley, and Lyme, we find, under the head of "The Gunton, Blickling and Woodbastwick Herds (Norfolk),"—all of which are thought to have been derived from the ancient wild herd of Middleton, in Lancashire,—the statement that "the first of these died out some thirty years since; the two latter still exist, more or less pure. All were domesticated."

All these existing herds Mr. Storrer personally visited, and his description of these visits is very entertaining. In stating (at page 163) that "Mr. H. H. Dixon ('The Druid') was the last person who published any account of the herd [Chillingham], in his 'Saddle and Sirloin,' in 1870, having seen it a few years previously," both Mr. Storrer and his editor have overlooked the article by Mr. A. H. Cocks, which appeared in the pages of this journal only last year, entitled, "A Visit to the existing Herds of British White Wild Cattle,"* a perusal of which would have furnished more recent statistics than those given in the present volume.

We have not space at our disposal to examine in detail Mr. Storrer's arguments. Suffice it to say that, although we are unable to agree with him in all his conclusions, and consider that here and there he has laid too much stress upon merely presumptive evidence, he has, nevertheless, produced a book which conveys a considerable amount of information, collected from various sources, and which should prove almost as interesting to the general reader as to the professed naturalist.

* 'The Zoologist,' 1878, p. 273.